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AUTHOR Penland, Patrick R.
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ABSTRACT

Three papers are presented which delineate the foundation of theory and principles which underlie the research and instructional approach to communications at the Graduate School of Library and Information Science, University of Pittsburgh. Cybernetic principles provide the integration, and validation is based in part on a situation-producing professional theory for both library and information science. Experimental research vehicles have been developed as verification matrices including both on-line and off-line components. (Author)

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# COMMUNICATION THEORY

(Three papers by Patrick R. Penland presented before the International Communications Association, 1969, 1970, 1971)

## Abstract

These papers delineate the foundation of theory and principles which underlie the research and instructional approach to communications at the Graduate School of Library & Information Science, University of Pittsburgh. Cybernetic principles provide the integration, and validation is based in part on a situation-producing professional theory for both library and information science. Experimental research vehicles have been developed as verification matrices including both on-line and off-line components.

Graduate School of Library and Information Science
University of Pittsburgh
Pittsburgh, Pa. 15213

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# Towards an Integration of Communications Theory

*Patrick R. Penland

## ABSTRACT

Three major communication situations or functions are related to the basic epistemological triad of perception, interpretation, judgement and/or problem solving. The first two communication situations of counseling and information retrieval are different in nature from audience message design. Communication dichotomizes between counseling and retrieval for the individual on the one hand, and message design for audiences on the other. The present widespread development of communication models relates most meaningfully and almost exclusively to audience message design. These models are often arbitrarily applied to counseling and information retrieval. The functions and relationships of three communication situations are explored as a preliminary approach to the problem of integrating communication theories.

## Introduction

The content of this paper is summarized in the accompanying diagram (end of paper) which aims to be a map of functional relationships. The diagram is to be read clockwise and even in one or two instances where counter-clockwise analyses are indicated by arrows, these reinforce the clockwise movement. Another essential notion to be kept in mind is the cyclical nature of the functional relationships which also tend to expand in spiral form. The starting point for most of the analyses will be the lower left apex of the triangle marked "perception." The actual process being described is probably nowhere in reality as neatly identified nor as simple as that indicated on the diagram. It is however an attempt to account for some of the complexity and diversity of human thought. The arrows going out from the center of the triangle hopefully assist in this analysis, and these represent three major areas in which human communication occurs.

This attempt to understand communication relies upon Alfred Kuhn's (Study of Society, Irwin, 1963) approach to epistemology which itself is based squarely on the concept and function of a biological adaptive control process. Out of the continuous stream of stimuli which impinge upon the awareness of a biological specimen some few of them are perceived, ie attention is given them for some reason or another. Perhaps

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*Associate Professor, Graduate School of Library and Information Sciences, University of Pittsburgh. Given as a paper, 1969 Conference, National Society for the Study of Communications.

it is caution, perhaps interest, perhaps it is because of potential need to solve a problem.

For whatever reason, some stimuli are given attention on the basis of the information they contain (as in the Shannon sense) and interpreted against concepts already available within the biological specimen and in light of his preferences. Previous judgements and values, ie his learnings, define the range and depth of interpretation. The interpretation leads to a verbal expression whether in the form of an observation or a judgement. In the human organism at least these observations and judgements are put together into sustained discourse units.

There are a number of situation-oriented theories of communication, but few attempts have been made to integrate these into a general model. The traditional linear models of communication do not apply as well to the counseling and retrieval function as they do to audience messages. Feedback may be an accepted component of communication. But simply to link a Wiener feedback loop to such prototypes as the Aristotlean-Shannon, or the Burkean-Duncan models of communication does not necessarily represent the complexity of the cyclical and on-going epistemological development within an individual, a group or an audience.

In the absence of any global theory of communication the accompanying diagram may serve to enumerate the various components of communication, its epistemological bases and the relationship of propositional logic to question logic and to that of counseling logic. Propositional logic is very old and the basis of message design. Question logic deals with the effectiveness of descriptive transformations within the framework of an interrogator initiated communicative retrieval. Counseling logic deals with the meaning, or lack of it, which enfolds in the interview where the client struggles to identify symbols that will summarize experience and, hopefully, help him to relate to organized knowledge.

Perception, inference and judgement appear to compose the triad of basic epistemological functions. Out of the continuous stream of sense stimuli in which every human organism is emersed some stimuli are given attention and are thus perceived. Some perceived stimuli may be ignored, some repressed, but some few perceptions are given further attention, related to previous experience, perhaps through counseling assistance, and interpreted in relation to an ongoing value and cognitive system within the individual. References may need to be sought from the communal store of scholarship, perhaps through retrieval assistance, and in any event, observations and/or judgements are formulated as basic ingredients of thought as well as of communication discourse units.

Some of these discourse units are "published," then collected and organized into library collections which thus subsequently adds to the store of world scholarship. But the great majority of observations and judgements made by the individual either remain unvocalized or become grist for the daily conversation mills and serve as a foundation for the considerable amount of interpersonal communication engaged in every day. In any event the observations and judgements of individuals whether recorded or merely vocalized serve as stimuli to the many informal

receivers with which the individual comes in daily contact. Eventually some of these messages may enter the basic and somewhat more formal communication cycle of show, discuss and apply, together with feedback or monitoring by which the source modifies future messages to an individual or a group.

The formal social communications cycle as distinct from the natural epistemological cycle upon which it is built, begins with a sensory intake process when some message is received. These perceptual inputs are made ready for use, ie placed in the behavior and/or communications mode in the process called thinking which includes percept storage, interpretation and concept formation. Thinking naturally leads into the decision-making phase, anticipates consequences as in mental problem-solving and then eventually commits an individual to a trial or response action. The trial completes the basic social communications cycle and leads into cybernetic consequences. As the individual thinks about what he is doing there is a constant and intimate interaction between any one phase of this process and its preceding and following phases. On the diagram arrows in a counter-clockwise direction indicate this added dimension of dynamic interaction.

Perceptual input detected by the individual from stimuli in the real world of sense experience is "negotiated" through value-selected concepts. This symbolization process internally within the context of the person, and externally within the context of the language results in the development of observations and judgements. Questions or uncertainties may develop at any point in the basic epistemological triad. Those which have implications for human intercourse may be investigated in the appropriate discipline by the scientific inquiry cycle of reliable observation, valid reference, logical message design and reporting. Almost certainly some questions will extend outward through the communications cycle of show, interpret and discourse feedback into the external contexts of culture, institution and value systems. The arrows indicate counseling, information retrieval and content analysis of audience-format communication as the three major communication situations. The first two, counseling and information retrieval, are significantly different in function from audience-format communication. So far at least most models of communication have been developed to explain audience-format communication and often are arbitrarily made to fit counseling and information retrieval.

## Counseling Communication

The identification of question asking in the diagram has been organized around three foci: counseling transaction, information retrieval, and audience messages. Counseling interactional analysis serves the purpose of the individual who has some lack in his cognitive environment and is unable to move satisfactorily away from sense experience into interpreted perception or concept. Interactional content analysis is a significant element in the stance of any interviewer whose purpose is to identify specific patterns of response (ie free-wheeling speech) that contribute to the purpose of the interview. In a sense any response to another's experiences is an inference about that experience, especially in the counseling

situation. On the other hand, while question negotiation for information retrieval may use the transactional interview, the goal of the interaction has shifted from cognitive development as in counseling to cognitive flexibility. In information retrieval, labels of content or descriptions, and abstracts which are products of professional concept analysis are employed by the reference librarian in an attempt to locate through the homomorphic transformations of indexing those portions of many communications messages relevant to the patron-initiated inquiry.

Underlying the three communication situations of counseling, information retrieval and audience messages, and not to be confused with any of them is intrapersonal communication. The movement from intrapersonal to interpersonal communication is essential to developmental counseling, especially when the emphasis is placed on the skills of reading, viewing and listening and in the affective, cognitive and skills considerations which must be developed. This process is similar to the problem-solving developmental goal achievements described by Robert Havighurst (Human Development and Education. Longmans,1953.) The dynamics of problem solving is a later phase of information processing which is initiated in an adaptive control organism as a result of perception. In the end problem-solving and information processing merge and become kinetic under the cyclical evolutionary development of the individual.

There are, of course, many functions of communication: to inform, to persuade ("courtship"), to command (organizational control), to intergrate (unit of command). At times it may be necessary to disregard intrapersonal communication. But we must be aware of what it is we disregard, because what goes on intrapersonally is an inescapable dimension of every communication event. Some components of communication are distinguishable, others not. Those not distinguishable fall into the general area of intrapersonal communication: how do the brain and nervous system work? how do sense stimuli get transformed into meaningful symbols? to what extent do reading, viewing and listening support intrapersonal communication? Consequently in the absence of answers to questions such as these theories make an attempt to bridge the gap.

Interpersonal communication is pervasive and fundamental to the family and to reference groups, and constitutes the bulk of significant informal communication throughout any community. Of the various levels of communication, interpersonal communication is least dependent upon communications technology such as writing or any other channel. The application of extensive technology would seriously inhibit its purpose and function. The function of interpersonal communication is to integrate the human organism, intrapersonally and interpersonally, whereas technology functions to send messages through time and space.

Counseling is a professional form of interpersonal communication whose purpose is to assist the individual to organize unresolved experiences and develop symbols with which eventually to interrogate any knowledge store and possibly even to prepare more or less formal communication messages of his own. Interpersonal communication is based upon an individual human organism which is a communication system unto

itself and does not require a speaker, message, or a listener in the sense these terms are used in audience communication. The human organism moves from intrapersonal to interpersonnel communication in an attempt to increase the number and consistency of meanings about its emerging needs and drives, as well as to meet demands of the physical and social setting.

Counseling as the first communication situation in the organic human development is an attempt to meet the human need for symbolization which should occur as a result of perception, but which may be delayed and/or suppressed through inertia or fear. It is often pointed out that the greatest need of adults, at least, is to relate a wealth of disparate experience to organized knowledge and in the process achieve a fuller understanding of one's self. Robert Gagne (Conditions of Learning, Holt, 1965) maintains that counseling is an essential prerequisite to any group activity. A problem, however, emerges especially among those with a lack of any great ability to verbalize, or fund of cultural background with which to organize experience, or perhaps through a lack of practice in doing so. Developmental counseling may be essential for such a person, or even theraputic counseling in those instance where experience has been deeply suppressed.

The goal of counseling is cognitive flexibility at least in a degree sufficient to effect symbols and eventually to understand his own experience. Understanding of symbolized experience develops the more rapidly as it is related to a store of organized knowledge, and it is at this point that the important profession of information science can be called upon for assistance. In order to be effective the individual must have developed the ability to use an index to the knowledge store. The index on other reference aid is built with the assistance of descriptive content analysis whose purpose is to abstract and describe the knowledge store by means of content transformations. Such transformations as abstracts and descriptors provide an entry point to the system. Once information is obtained the individual can the more readily develop observations and judgements, and organize them into sustained discourse units.

Retrieval Communication

Information science is concerned with the transfer and use of information as requested by an individual who interrogates a store of documents. The individual wants to receive such information (selected from various senders) as will determine, or modulate, to his satisfaction some anticipated personal form of activity or cognitive state of affairs. The interrogating organism has a readiness to respond. The information obtained and judged to be relevant determines the form of activity or state of affairs which occurs.

Information science uses content analysis for its potential ability to control knowledge growth and development, as well as for its power to transfer information based on retrieval strategies and indexing efficacy. Information science endeavors to organize the connotative and denotative aspects of language. But the former aspect of connotation remains a formidable problem in any effort to formalize natural language, and formalized it must be, at least to some extent so that retrieval reliability is predictable. Denotative reduction, as in an indicative abstract, can be treated by more logical methods but, of course, does not include the connotative reduction or informative abstract of the source's message about the subject.

Indicative abstracts indicate what the document is about and consequently have the same purpose as indexing. The informative abstract on the other hand summarizes not the subject, but what the document says about its subject and as such would appear to introduce inappropriate elements into indexing languages and schemes for retrieval purposes. In information science, indexing languages serve as the major method for subject description and to a more limited extent subject control. Indexing provides a common ground between indexer and searcher. Indexing language makes it possible to format the content of both documents and search prescriptions and thus secure a maximum matching of the two in retrieval operations.

Certainly information science would profit by divesting itself of the connotative analysis of communication messages, or at least working in conjunction with researchers trained in inferential content analysis. Relieved of this pressing concern and concentrating upon the study of denotative transformations, information science might advance more rapidly towards its goal of an academic discipline rather than remain a profession as it now appears to be.

Cross-media analysis can of course investigate such transformations of phenomena that are isomorphic and/or homomorphic. Professional content analysis for content specification and control is largely concerned with homomorphic (reductive) transformations. The analyses are used to develop descriptive labels whose predictability for obtaining requisite information can be measured with some degree of precision. The further question as to whether document content can be reconstructed from its descriptor set is as yet a wilderness lacking investigation and research.

Though scarcely more rigorous in investigation isomorphic cross-media analysis has received somewhat more attention. Jesse Shera, (Libraries and the Organization of Knowledge, Archon, 1965) in his work on the social epistemology of knowledge has conceptualized the whole field of bibliography on a level that can more readily be assimilated into communication theory. Whether this viewpoint will lead to a world encyclopedia of recorded knowledge remains a large question. But this viewpoint apparently relates to the ways in which the same thing may take on different appearances, as when a subject or one of its topics can be presented in various formats such as bibliography, dictionary, handbook, cyclopedia, etc. Each of these is known by a different conceptual formulation. Gardner Murphy calls this the Spinoza principle of organization, ("Toward a Field Theory of Communication," Journal of Communication, 1961, 11:196-201).

Audience Messages:

In referring to the accompanying diagram, the lower right hand apex of the basic epistemological triangle indicates that the formation of observations and judgements leads to their logical organization into discourse units. Commonly accepted word-concepts are used to build the discourse unit composed of thoughts and feelings. Conventional methods of composition help to signal identical or sufficiently similar word-concepts in order to receive thoughts and feelings. Comparable logics of content and sequence aid in the presentation of the discourse unit and its reception by the audience for whom it is designed.

Message design includes some defined area of knowledge to be communicated to a learner. The set of objects and events to which the message refers is the referential element. The cognitive element is the set of observations by which the information about the referential element is integrated into a logically meaningful expression. The communicative element is the set of judgements by which the cognitive element is made communicative or available to the receipient, ie personally (individually) meaningful. The communicative or learning requirement is fulfilled to the extent that the message is geared to the appropriate intrapersonal communication skills and synchronized to channel specifications.

Not only is message composition an especially pertinent and significant activity in the communication process but also the channels must function reciprocally and be synchronized with whatever equipment is necessary for their efficient operation. A particularly appropriate example is the communicating of a new library service for the underprivileged. Not only must the readability of the message be taken into account, ie the intrapersonal communicating skills of reading, viewing and listening, but also the channels to be used whether print, audiovisual or media.

The expected impact of a message upon an audience cannot be ignored, nor indeed for that matter the intentions of the source in creating the message. Questions such as these are investigated by inferential content analysis and deal in part with the connotative aspects of language units. From our present state of knowledge it appears that inferential (research) content analysis can handle questions about the connotative aspects of language much more adequately than the descriptive transformations of the information scientist.

Discourse units, whether oral or recorded, become at least potentially a part of the total socio-knowledge communication system which is transmitted to the society in the form of messages to audiences. Two major social institutions exist for this purpose: education and the mass media. Content analysis is used as a method for testing hypotheses about the intentions of the source and the probable affect of the message on the audience. For this kind of analysis, the regular models of communication are useful for hypotheses development such as the Aristotlean-Shannon-Wiener model and that of the Burkean-Duncan model.

A good many models of communication exist and each one adds to our understanding of the total communication process. The Aristotlean-Shannon-Wiener complex gives a sense of explanatory direction to the development of message design, message transmission and message evaluation (operationally through the feedback loop and for research purposes through content analysis). Its essential characteristic is target-directed whether the target is stationary in the Aristotlean-Shannon phases or highly mobile as in the Wiener phase.

The models of Lasswell, Gerbner and others in part add to the extension of the Aristotlean-Shannon-Wiener model, and in part anticipate the socio-drama complex of Burke and Duncan. In the Burkean-Duncan complex, communication becomes part of the social fabric as do such concepts as culture diffusion and acculturation. Certainly communication seems to be more of a social system than that of message design, transmission and evaluation. Orchestration of the media and saturation coverage are keynote characteristics of the socio-drama model.

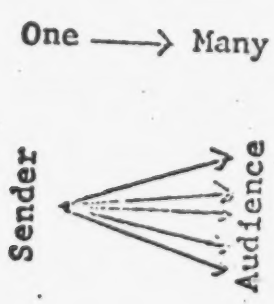
These two communication complexes however have one thing in common and that is directed message transmission to a target group whether stationary or mobile in order to saturate a community or social unit so as to make it difficult for audiences to avoid thinking about the message. Aimsmanship and/or saturation are used by senders to accomplish their purposes albeit modified out of necessity by feedback.

The information retrieval and transfer process on the other hand functions differently even though, on the evidence of the record, information scientists continue to blind themselves differently and deliberately. Of course, they are right as far as indexing, per se, goes in its denotative aspects, and perhaps even in the connotative aspects were inferential content analysis used to probe sender intention and audience impact. But in both instances sender intention and audience impact is probed and analyzed from the sender's frame of reference.

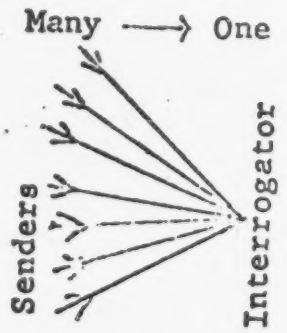
Summary

At this point it is important to pause and consider the essential difference between the communication function at the audience-format level from communications which exist at the counseling and retrieval levels. These types of communication differ in nature. The message may move in a similar direction from sender to receiver in both instances, but in the latter two cases communication does not occur unless the interrogator initiates an inquiry. Information is sought from many sources or parts of sources and may not be located in any single one of them but is found only as a product of the set or subset of sources consulted.

The individual (helpless at times) for whom all of this is being done anyway, stands in direct constrast to the target audience characteristics of the other models. The information scientist is presumably working to serve an individual interrogator and not an individual in the mass. In information retrieval the individual initiates communication, depending upon his interests and cognitive flexibility. He interrogates a system from his frame of reference and symbol system. He selects messages (or portions of them), decides upon their relevance and obtains information in the process that may not be explicit in any one or even a subset of the message resources used. This kind of communication is in a many-to-one direction, but it significantly flows only, when and in amount exactly under control of the interrogator.




Traditional Model of Communications



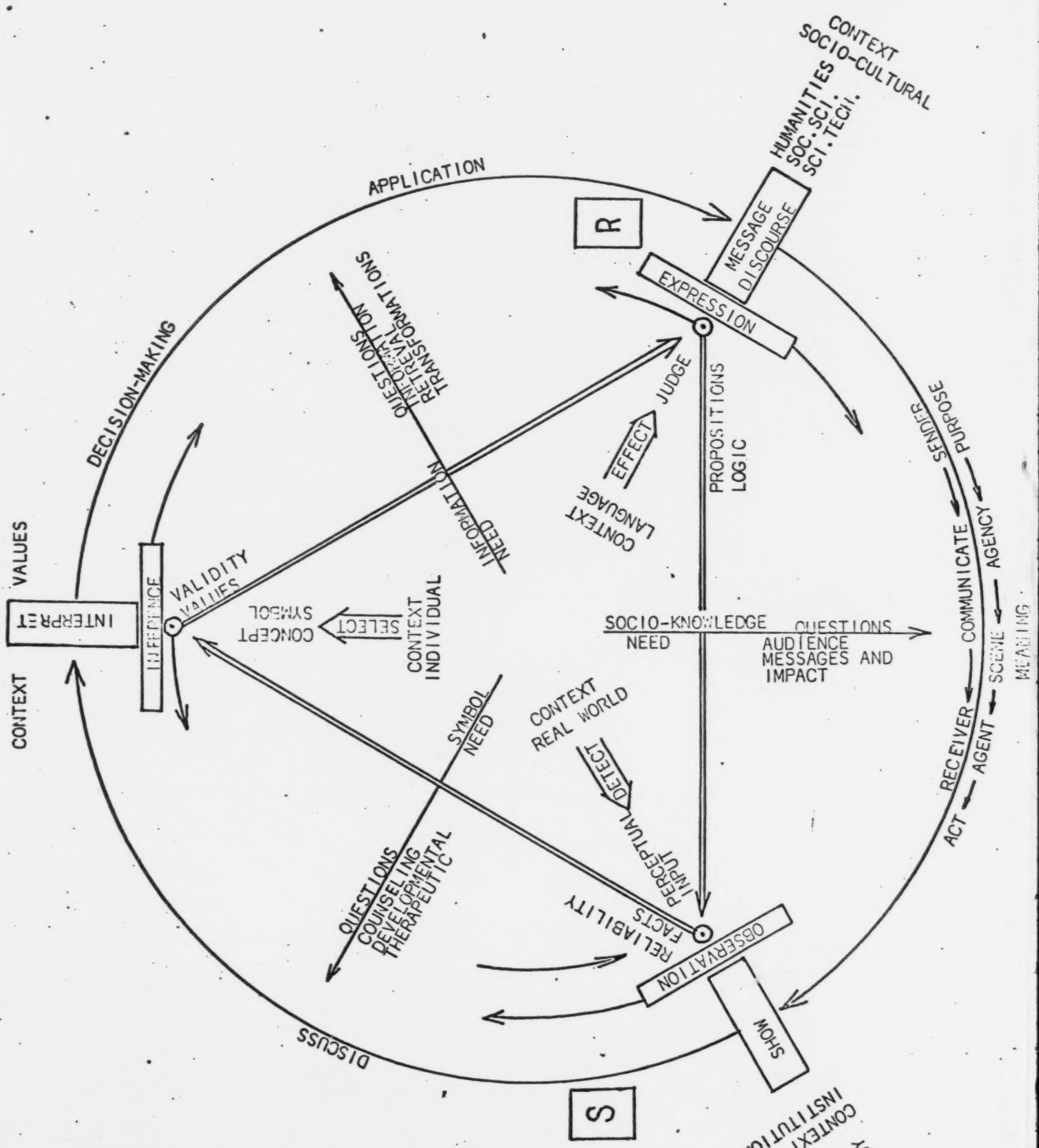

Retrieval Model of Communication

One may of course view this process as receiver initiated communication but there is a one-to-many mapping in a direction opposite to that of the more familiar communications sender system. The receiver interrogates many sources. However in most instances, the interrogator does not use the entire message of any one sender. This model of communication has a considerably different pattern from that of the traditional sender-receiver model. This model is concerned with question coding when working with a client and message coding when indexing documents in preparation for service to clients seeking information.

In his work the professional content analyst is constantly preparing for communications situations in which a receiver initiates contact with the source(s) and as such reverses a significant aspect of the usual communications relationship between sender and receiver. In the usual traditional models of communication the sender transmits a message through a channel perhaps to one person as receiver but most often, unless the message is strictly a private affair between intimates, transmission occurs in a one-to-many relationship and rigorously hierarchial format. The source sends a message to an audience composed of many individuals and research content analysis is designed to investigate the intentions of the sender and audience effects.

On the other hand communications retrieval systems provide, on demand with maximum precision, information relevant to questions posed by individuals. This model is concerned with question coding rather than message coding -- these being questions about perceptions rather than statements based on judgements. The logic of question formulation is not nearly as clearly developed being individually perceptual and transactional.

Questions are formulated according to the way each individual has of perceiving nature and as a result the received responses to questions may not always be relevant. Questions result from fundamental hypotheses in the requestor's thinking and shift from one to another hypothesis as perceptions continue to occur. The initiation of communication by a person approaching an information retrieval system is based upon verbalization peculiar to his own thinking. The problem then occurs when it becomes necessary to design a communication system that can be triggered into operation by the verbalizations of requestors rather than by the authors of communications messages stored in the system or in the abstracting and indexing of these messages by designers of the communications retrieval systems.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# COMMUNICATION PRODUCING THEORY

Patrick R. Penland*

## ABSTRACT

There are two basic models of communication in which a variety of theories of communication are embedded. The linear, traditional model of communication yields separate taxonomies for the subject disciplines and for the professions which sometimes are at variance with each other. The cybernetic model of communication and its component theories yields a taxonomic matrix upon which a general professional taxonomy can be mapped. The two models of communication become elements of one system which the disciplines and professions can use to advantage in producing cybernetic situations, rather than sequential messages. This article carries on the discussion which was initiated in "Towards an Integration of Communication Theory" presented at the 1969 ICA Conference.

## Communication Producing Theory

In the past, there has tended to be a considerable difference in communicative emphasis between the academic disciplines and the professions. The academic disciplines were expected to create new knowledge through basic research. Traditionally, the disciplines were dedicated exclusively to the creation of new basic knowledge without regard, for example, to the possible "surprise" value of the information in problem-solving and decision-making. On the other hand, the professions were organized to achieve some social purpose. Existing knowledge was communicated by the professions in such a way that information would reduce personal and social entropy. The professions could be roughly characterized by the way in which they worked to make the knowledge created by the disciplines useful to people. It then became the responsibility of the professions to put this knowledge to use, i.e., to make knowledge kinetic in the lives of people.

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*Associate Professor, Graduate School of Library and Information Sciences, University of Pittsburgh

In general, there are four major professional methods of communication: consultation, education, mass media and information retrieval. The consultative professions like law, engineering, medicine, of course, are still expected to bring knowledge to bear on the actual problems of people until a solution is reached. On the other hand, the method of education including informal adult education is to summarize aspects of knowledge and through training improve the thinking skills of the individual and the group. The mass media provide a constant rain of information about the near past and current events as they unfold in the present. Information science makes it possible for people to obtain information from a source or as a coordinate product from two or more sources.

The rationale for the dichotomy in function of communication between the disciplines and the professions was usually based on the traditional, linear model of communication whose component theories stretch from Aristotle's Rhetoric to Shannon and beyond. Even today, there are a good number of linear theories of communication being proposed which base their approach on the psychological, sociological or engineering characteristics of the usual sender, message and receiver. The linear model is, of course, useful for descriptive studies and a great deal of communications research has explicated the five W's of Lasswell's formulation, "Who says what, to whom, in what channel with what effect."

However, when it comes to an analysis of the conceptual components of communication, their relationships with one another and to the parameters which operate on an adaptive control organism, the descriptive linear model is not sufficient. Nor is the linear model of much use today when the movement towards the unification of science, knowledge and the professions is much in vogue. Not that fashion should be an arbitrary master, but the integration of knowledge and human endeavor holds much promise for more effective and useful (to the public) systems of communication.

The purpose of the systems approach to communication is to overcome the linear, sequential and frequently dichotomized analyses which to the receiver at least often appear to be necessary. The systems approach to knowledge and the professions makes it possible as Ross Ashby (1) says for a person to contact and enter the communication network at any point and be able to move to any other point in any direction he may choose. With the systems approach, based on the cybernetic model, the professions can serve as watchmen for knowledge lacunae and recommend to the disciplines the creation of new knowledge whose information can be expected to reduce entropy in anticipated areas of social concern. Individual researchers in the disciplines may still create knowledge for its own sake, but the discipline as a whole will become more socially responsive and profit as a discipline from an integrated and symbiotic relation with the professions. Consequently, the dichotomy between the disciplines and

the professions is gradualllly being replaced by a symbiotic relationship based on the cybernetic model of communication and its component theories.

This new symbiosis results from the ubiquitous cybernetic model of communication which is equally applicable to the disciplines and professions. The cybernetic model as developed by Wiener (2) in electronics and by Cannon (3) in biology is more productive than the linear model for both integrative and analytical purposes. In the general cybernetic model, information is the input stimulus than "surprises" (Shannon) the perceptual apparatus of an adaptive control organism or mechanism. The perceived information is processed by the interpreter or governor within the adaptive control organism and some reaction occurs. The reaction when evident appears as behavioral output which is fedback to the perceptual apparatus of the organism and/or to the parameter(s) which stimulated the original inputed information surprise. Figure 1 is an attempt to illustrate these dynamic and helical relationships.

In order to exert intellectual leadership, the professions need a more explicit theory of their function in producing communication situations. A situation-producing theory of communication for the professions exists in prototype (4) (5).

According to Dickoff, each profession is aware of some state(s) of disorder, social or personal, which it endeavors to overcome. In addition, each profession employs a set of control devices, or professional methods peculiar to it, to bring order out of confusion. In other words, the profession in some way helps people, groups and communities achieve negative entropy. It is in one or more of the areas of dyad (6), group (7) and community (8) that communicative situations are produced by any profession.

There are, no doubt, as many cases of disorder or entropy as the plethora of perceptions of every individual in every culture. However, for the purposes of categorization and analysis, many writers have posited three major areas in which entropy is continuously present. For convenience, the codification of Hall (9) may serve as a summary. He has listed these areas as informal (personal), formal (social) and technological (environmental). Hall discusses the achievement of order in each of these. The three areas appear to consitute the overriding concerns of any culture in reducing entropy and thus become the source of purposes or objectives for any society to achieve.

The cybernetic model of communication is unique in its ability to accommodate both the contexts in which communicative activity occurs and the systems of entropy reduction in any culture. But before proposing a taxonomy of communicative situations based on the

matrix of contexts and systems, it is necessary to identify the general professional methods which a society creates and delegates to a profession in order for it to bring about an interface between the knowledge which that profession has to offer and the entropy-reducing needs of people in various cultural milieux.

According to Dickoff, the general professional entropy reducing elements are six in number and were originally phrased in the form of questions. The answer to each question is a general element and a more specific answer in needed for each individual profession: (1) Who or what performs the activity? (AGENCY); (2) Who or what is the recipient of the activity? (CLIENT, PATRON); (3) In what context(s) is the activity performed? (SITUATION, SCENE); (4) What is the end point of the activity? (GOALS, TERMINUS); (5) What is guiding protocol of the activity? (PURPOSES, POLICIES, PROCEDURES); (6) What is the energy source for the activity? (MOTIVATION TO SERVE, TO PARTICIPATE, TO COMMUNICATE).

The reader, of course, will not miss the obvious point that Dickoff's formulation resembles by analogy the Lasswellean five W's. It is not the purpose of this paper to downgrade the contribution of the traditional linear model of communication. On the contrary, without an understanding of it, it is impossible to appreciate the rich synthesis of the cybernetic model which includes in its gestalt the communicating persons, message content with its ever-changing symbol meanings, and the technology of communications with its possiblities for man-machine interface.

The interrelationship of the linear model and cybernetic model of communication can be best appreciated by mapping the elements of Dickoff's formulation onto the matrix formed by the three communication contexts and the three negative entropy systems. The following diagram (Figure 2) represents a general distribution or mapping of points of first focus, i.e., Ashby's entry points into the system from which the individual, the group or the community can proceed to any other point in the system. The mapping is suggestive and not simply one-to-one, because facet analysis of the elements in relation to the entry point of emphasis would yield an infinite number of combinations.

It is difficult in a matrix to represent the cyclical and helical dynamics of the adaptive control organism. However, the attempt to map professional elements onto the communication contexts and the entropy-reducing systems of the cybernetic model reveals not only some functions of the particular profession, but also its relationship to the subject disciplines which are becoming more and more interdisciplinary. The professions by their nature have always been interdisciplinary in making knowledge kinetic in the lives of people. Information from any discipline is exploited for its relevance to the problems and interests of the people served by that profession.

The final diagram (Figure 3) represents the cybernetic involvement of a communications-producing profession employing communicative contexts and negative entropy purposes in order to create appropriate messages. Message is defined in the broad sense to include any activity of a profession and the subsequent set of behavioral objectives to be accomplished. Thus, a cybernetic communicative situation can be more complex and effective in producing change than sequential message design.

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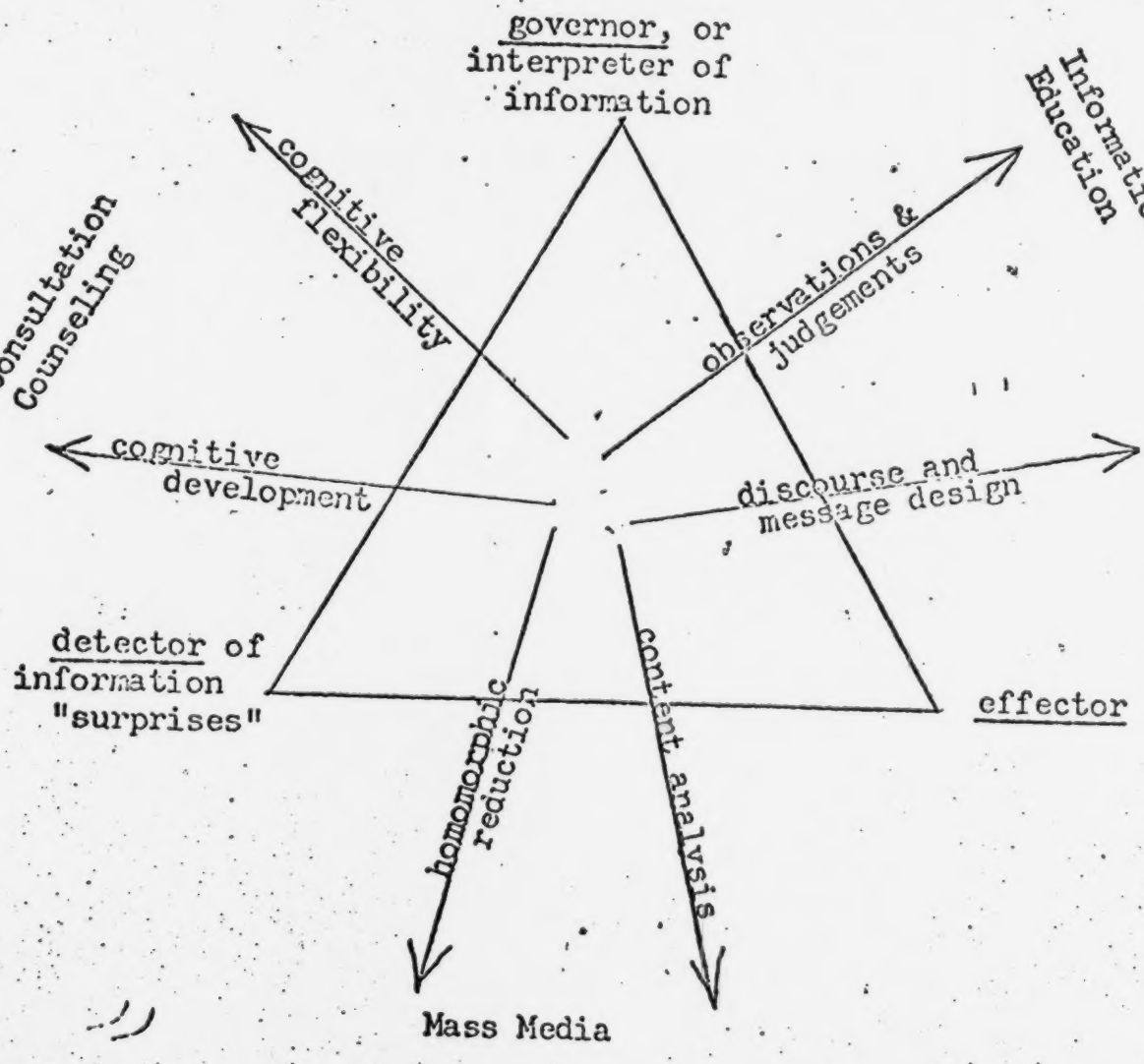
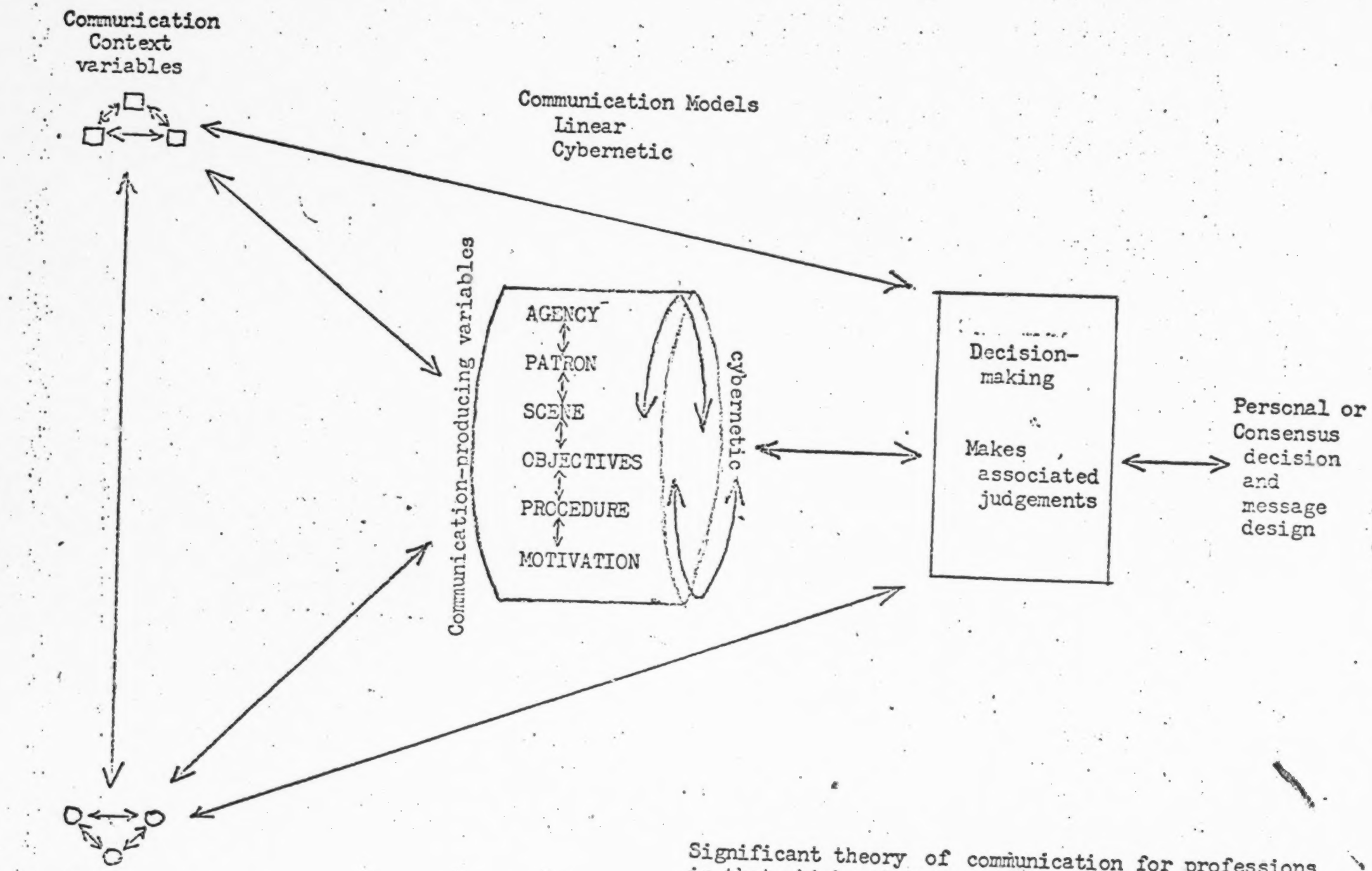

governor, or interpreter of information
Consultation Counseling
cognitive flexibility
observations & judgements
Information Retrieval Education
cognitive development
discourse and message design
detector of information "surprises"
effector
homomorphic reduction
content analysis
Mass Media

FIGURE 1

| Communication Contexts / Entropy-reducing Systems | DYAD | GROUP | COMMUNITY |
|---|---|---|---|
| PERSONAL | Motivate to communicate.<br>Thinking, cognition, inference.<br>Skills of liberal education.<br>Counseling & consultation. | Motivate to participate.<br>Group sensitivity.<br>Group learning. | Agency's knowledge to diffuse. |
| SOCIAL | Client peer group.<br>Reference groups.<br>"Talking chains". | Administrative situations.<br>Organizational scene. | Agency purpose & policy.<br>Coordinating Community council.<br>Cybernetic community development. |
| ENVIRONMENTAL | Create new knowledge.<br>Research, publishing.<br>Primary & secondary scholarship for "world encyclopedia." | University faculties.<br>Subject disciplines.<br>Scientific & Technical societies.<br>Professional societies. | Language & culture.<br>Knowledge storage & control.<br>Networks & systems for information control & transfer. |

FIGURE 2




Significant theory of communication for professions is that which enlightens professional about patron and his situation, ie. helping individuals, groups and communities with symbol development and information problems when their motivation, or ability, or knowledge is not sufficient.

FIGURE 3

MODELS OF COMMUNICATION

# CYBERNETIC COMMUNICATIONS RESEARCH

Patrick R. Penland*

## Abstract

There is a pressing need for research to test the cybernetic model of communication. This need is met in part by an experimental community encounter system, where the entropy reducing components of the cybernetic model operate in a simulated social system. This system has been developed at the Graduate School of Library and Information Sciences, University of Pittsburgh for research and instructional purposes. Demographic, land use and legal data of Allegheny County (metropolitan Pittsburgh) serve as a cold-start constraints before fifteen weekly cycles carry the encounter system fifteen years into the "future." The on-line/off-line model is cybernetic in terms of its response to in-put (man or machine) and can cause new interpretations of the response by those receiving the input for the next cycle (man or machine). The theory for the entropy-reducing components of the cybernetic model has been explored in two previous papers before the International Communications Association: "Towards an Integration of Communication Theory" (1969); "Communication Producing Theory" (1970).

## Introduction:

Since communication is the process of creating situations (dyad, group, community) in which meanings can be engendered in people (1), then considerations of community context cannot be ignored by those in the communications profession. In general, it is the function of the disciplines to create new knowledge (largely for its own sake). On the other hand, the professions endeavor to make knowledge kinetic (information surprise) in the lives of people and call attention to lacunae in knowledge which if researched and created by the disciplines, would be socially useful (2). Without this symbiotic relationship, the disciplines become overly academic and the professions waive any leadership role for civic betterment and social accountability (3).

Until recently, no underlying theory of the societal enterprise existed which was not a static model. Even the model proposed by Hall (4), whose

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*Professor of Library Science and Education, Graduate School of Library and Information Sciences, University of Pittsburgh

concept of "awareness" is particularly insightful, cannot easily be related to cybernetic theory (5). There exists however the socio-drama model of Burke-Duncan (6) which can account for the cybernetic interaction of community endeavor. The rules of the social enterprise constitute the behavioral outcomes of the roles played by adaptive control organisms as they react cybernetically to the perceptions of latent and even explicit social entropy.

The adaptive control organism has a built-in and dynamically creative antipathy to entropy. Necessity may be the mother of invention, but the imperative to escape entropy is the critical social matrix of significant symbol. Men demand structure almost more than bread as the reasoned and concluding statement of Brinton in his Ideas and Men (7) would indicate or as the pessimistic pronouncements of Toffler (8) would in a negative way try to panic the social enterprise.

Granting that men demand structure, the tragedy has been that most social theoreticians have proceeded in their analyses upon the basis of mechanistic principles (9). However an alternative position has been developed which cybernetically shapes the referents of the symbolic enterprise. The cybernetic structuring processing of the symbol releases participants from both the mechanisms of the mores as well as the Berkeleian solipsism. This model has been embedded in the community encounter system developed at the University of Pittsburgh with both on-line and off-line role components.

In the community encounter system, constraints are abstracted from societal patterns and operate within the democratic rules of gaming procedure. Participants deploy themselves according to models of communication,

employing sociodrama for its function of guiding social criticism and information surprise as the motive for change. While the inclination of powerful elements in the social order is towards criticism only, information supply is positive and developmental, encouraging other participants towards a "profiles of courage" approach.

In order to realize its cybernetic potential, communication science must in Duncan's words "take into account what was communicated, the situation in which the communication occured, the kind of person who communicated (i. e. his role), the means he used, and the social purpose of his communication" (6:17). Duncan goes on to develop his thesis in the explication of several axiomatic, theoretical and methodological propositions. These are the propositions of sociodrama theory which may be refined as they are verified through research design. It is one thing to talk about research design in the sense of traditional social science (10). It is quite another to determine and assemble the research contexts wherein theory can be verified, let alone establish experimental vehicles for the testing of hypotheses.

Community Encounter System:

There is a need to know more about the communicative abilities of humans as well as the means for predicting such ability based upon experimental techniques which minimize error and maximize yield of information. The community encounter system has been developed to study an on-going simulated environment which facilitates research on the problems and component relationships of communication. The encounter system provides for a gestalt of social activity wherein the entire gamut of human communication

can be studied. The encounter simulation provides a central focus in the development and evaluation of new programs and methods as well as the social justification of existing ones. It also focuses attention on the need for long range systematic research as a basis for planning situations wherein effective communication will be engendered.

For example, on an elementary level, videotapes and the computer have already proved much more effective in recording complex behavior for measurement purposes than the traditional pencil and paper methods. Of course the "cameramen" are under control of at least one researcher to ensure that its "selective eye" follows the "sense" of the dynamic encounter situation being recorded. The computer monitors the input of each role participant, provides read-outs of individual and group performance as well as statistical analyses and updates the constraints for each succeeding weekly (annual) cycle.

The encounter simulation is a unified model of communication based on a very few principles which are available in cybernetics. Cybernetics in its assumption and principles is sufficiently general to consider it a unified approach to communication. It can be a powerful tool for communication analysis. Homeostasis is not simply a response to a stimulus, but a process occuring in all parts of the encounter system and results from a transactional process among ever extending sub-systems. Cybernetic analysis can be used to diagnose interpersonal relations and categorize such transactional behavior as the communication components which accompany the self-stabilizing interactions of the entire encounter system. The transactional process requires communication of information and motives at many levels. Information

processing can be related to the activities of learning, thinking and understanding.

The advantage of cybernetic analysis is that the model transcends subject boundaries, and views people and institutions as adaptive control systems of reception, transmission, evaluation, and storage. Input is perception; judgement is decision-making; and output is behavioral action. The findings of the newer "interdisciplinary" social sciences have been synthesized in order to explicate the three components of the cybernetic model. This encounter model has been developed to replace the verbal speculation of the older social sciences with the on-line and off-line cybernetic components of reception, decision-making and behavioral patterns.

The teleological thrust of the off-line roles is toward cooperative or competitive behavior for valued ends by employing the entropy reducing functions of cybernetics for research purposes. The findings of each of the newer social sciences shed light upon, and delineate research matrices for the functions of the three components of an adaptive control organism. The following table which is somewhat more abstract then Figure 1, indicates the cybernetic components of the community encounter system which has been developed for research and instructional purposes:

Cybernetic Model Components

| Perceptor | Interpretator | Effector |
|---|---|---|
| Organized and projected information | Role-structure (off- and on-line) | On-line Data Matrix |
| Mass Communication | Cognitive structure: | Land use |
| Organizations | organized information space | Finance |
| Talking chains | Affective structure: | Legal |
| | power | Demographic |
| | government | |

The first component, stimulus and reception, has been explored in the disciplines of information theory, linguistics, sign and symbol behavior which together lay a foundation for the analysis of information surprise. From a cybernetic system-model point of view there are two basic purposes for communication: to inform and to motivate. Communication functions to alter a receiver's concepts and to change his preference and feelings so that a wider range of alternatives exist for decision-making and behavioral response. In the construction of a message, it is necessary to build in informational and especially motivational referrents (11). However, according to the sociodrama model of communication (6) and the experience of the mass media in persuasive communication, motives are changed first and then concepts are filled in.

Human behavior is the output of a controlled, not an uncontrolled system. This viewpoint is consistent with the analytical concepts used in communication, decision-making and systems analysis which are considerations in the selector and effector stages of the cybernetic model. In addition, they are similar to the informational and motivational aspects of communication, to the opportunity and preference functions of decision-making, and to the broader cultural notions of scientific and value judgements in society. Interpersonal relationships and transactional analysis in group, organization and community endeavor are means of enlarging opportunities directly both in concept effectiveness and preference strength.

Human behavior is based on information about things, not necessarily on the nature of things. The human is able to accumulate reservoirs of

information over a period of time through a process of symbolization or conceptualization. Concepts can be of things as well as of events. Once information is stored in the form of concepts, it can be tapped, or released, by cues. No action or cue can occur at a distance without some connection either of a cause-effect or a feedback relationship. The cause-effect action, no matter how complex, proceeds in one direction and is common in the natural environment. A feedback system, however, involves mutual cause-effect relations which can be studied by the multi-correlational analysis of many variables.

Freedom of opportunity varies directly with an increase in number of information sources and depends on access to communication media. Mass media constitute a major stimulus source for social endeavor as well as the community encounter simulation. In order to maintain a bargaining advantage, the flow of information can be curtailed about the matters under bargaining. Where information cannot be controlled directly, perception may be modified by criticizing communication content or by raising compelling points of view against it. In any event, organized information space (library as prototype) is considered to be of surprise value as well as serving as an entropy-reducing function, whether the "beings of reason" included were developed in the past or are emerging at the present moment.

The second component, the preferential phenomena of interpretation, is explored in the disciplines of game theory, decision theory, value philosophy and psychology which taken together help to explicate the preferential patterns of the adaptive control organism. Descriptive and normative studies of decision-making have led to the analysis of aspects of

human behavior in which choices are made among alternatives. For example, Simon has pursued the ramifications of decision-making and value theory in his Models of Man (12).

Any cybernetic system has both input and output. The effect of the environment on the system is input, while output is the effect of the system on the environment. Within the system, the effect of one component upon another is a functional relation or interaction. In a cybernetic system, the governor or selector is set by the larger or encompassing system. For example, the value system of a human individual is not calibrated by the individual alone, but mainly by the cultural system. The setting of the governor or the establishing of values for controlling behavior is a parameter of the cybernetic system determined by the larger environment and during the traditional experimental study of a system is supposed to remain unchanged. However, in the correlation analysis of nonparametric distributions, it is not essential to hold independent variables under rigorous experimental control. No a priori ideas need be placed on the distributions under study.

Almost any action of one person with another produces feedback, the action and feedback being the transactional use of power. Power is the ability to do work in the physical sciences, and the ability to satisfy wants in the social and policy sciences. The bargaining strength of one individual varies inversely with his own effective preferences and directly with the preferences of the other. Reciprocal demand is the basis of all transactions whether interpresonal or societal. Power is only as strong as the effective preference, and the limits on equilibrium within the

transaction are set by the parameters of available alternative opportunities. Figures 2 and 3 indicate that a fundamental dichotomy exists between cognitive (information) and affective (power) elements of the library vs. governmental entropy-reducing complex.

The third component of the adaptive control organism is explored in the disciplines of general systems theory and operations research. General systems theory has grown out of the work of Lotka (13) and Von Bertalanffy (14) where generalized models, principles and laws are applied to the physical and biological behavioral systems and their subclasses. Operations research on the other hand is the applied component of general systems theory. It brings the systems approach as well as its intellectual and interdisciplinary resources to bear on organizational problems. Ashby (15), Nagel (16) and Latil (17) have explored the relation of software and hardware in operations research employing computers, automata and other control devices. In the community-encounter research vehicle, general systems theory has been taken into the future, as the encounter system investigates the impact of behavioral outcomes today upon the information processing and decision-making of tomorrow.

The Research Vehicle:

Following Ashby's postulate that cybernetics is the theory of all possible machines, organisms and combinations, the encounter system is an integrative model and a guide to the planning of individual research studies and components for an explicit galaxy of research "designs." Uniformities among the various subjects and professional disciplines have been incorporated into the simulation model. The generality of social science

research findings (18) has been extrapolated to the encounter system and integrative benefits have been derived from comparing theories in apparently diverse fields.

There is one area of communications research to which a program of investigation in the encounter simulation leads directly. Professional education is based upon an academic grading system which, while it may be pertinent to a degree program, does not necessarily ensure role definition and development. The encounter simulation creates situations in "real-life" standards of effective communicative behavior can be developed in context. In addition to evaluation which reflects content gain or progress, role definition and development can be evaluated in relation to defined group norms.

Actually from the studies already undertaken there is a reason to believe that research employing canonical correlations in the encounter simulation can be as productive as investigations carried out in highly organized experimental frameworks. "Value free" distributions may be logically desirable but in communications research are difficult to achieve. The advantages of research in the encounter simulation lie not so much in the degree to which the findings are rigorously verified, but rather in the large repertoire of types of studies that become possible and in the built-in stimuli to inquiry. Because of the nature of the encounter simulation, the faculty and participants have the combination of energy, insight and integrative effort that is necessary for constructive inquiry about fundamental problems.

Before experimental research can be undertaken in social communications, many studies need to be conducted in contexts employing statistical controls rather than experimental controls. The distribution of variables must be identified and compared not only with one another but also with the characteristics of the components and subcomponents of the encounter system. Instead of specially selected subjects who might fit more readily into traditional experimental design, subjects are the students who register in the communications sequence. Considerable progress has been made in the development of evaluative instruments, including devices which as final instruments in one phase of evaluation can be used as initial measures at the beginning of another.

After all, there are really few indispensable elements in research design that cannot be conducted in the encounter system. The instructional personnel responsible for the library-community encounter simulation have a research point of view and possess knowledge of appropriate experimental and statistical techniques. An office of tests and measurements has readily available not only instrument to measure achievement as well as participant characteristics, but also has the resources and the means for test development, administration, scoring and statistical analyses.

Except for the randomization of treatement groups, many experimental controls can be applied after the observations are collected. Groups can be stratified or matched after the experiment is completed just as easily as before. Whenever the original groups are large enough to permit fractionalization, specifications can be imposed on the groups during the analyses. Computers can be programmed to accomplish this readily. In the

matrix of intercorrelations and weightings, the unique contribution of any of the independent variables can be determined by factor analysis. Any variable can be interchanged as to whether it is to be used as a control or as a predictor. A system of experimental inquiries will generate valuable results without designing a new experiment for each new set of conditions.

Older social science methods of research have been evaluated in relation to components of the encounter system and to characteristics of senders and receivers. In addition, new methods and devices not only are being invented but they also are being evaluated in relation to "established" procedures. New methods can be evaluated relatively easily without radical disruption of the encounter simulation. For example, subject groups need not necessarily be matched. Nor do they have to be of the same size or even be concurrent. It is however necessary that the "control" groups be measured for initial level of skill or knowledge to be communicated as well as for all the characteristics under consideration as referents.

Experimental control as employed in the social sciences with human subjects uses a limited range of one or two variables. The subjects may be selected to yield predetermined distributions, or members of like pairs, or triads, or quartets may be assigned to treatment groups, usually at random. Treatment is the independent variable, residual gain the dependent. However, other variables may be used for control. Correlational analysis or canonical correlation permits the use of conventional significance tests as to whether changes in the skill or variable under study are related to method. Also through analysis of variance the practical importance of changes may be assessed to better advantage than in the usual experimental designs.

Summary:

Organization adds to the transactional model of communication but one element of structured cooperation which includes the development of goals and the shared experience of values or motives. With organization comes the complications of increased roles but also of relationships among the sponsors or owners (if a business or industry), the staff and the recipients. The whole society is an organization. Government is the formal organization of power. Property and legal rights constitute the set of rules about transactions. Transactions among citizens are constantly going on and continuously being formalized into "permanent" coalations. For government not to intervene in the transactions of power groups is to sanction those transactions. The scope of government is total for its society since its actions and inactions cover all possible situations.

The adaptive control organism is most productive when the cognitive and affective domain work together in a complementary manner. However such an harmonous relationship is neither always the case nor possible. Be this as it may, both realms are essential components of the community encounter system. Figures 2 and 3 delineate this cooperative vs. competitive interaction which is the matrix of the social enterprise. The encounter system is composed of participant roles and the first line of research has focused on the entropy-reducing functions of communication (information) agents. This depends not only on the manner in which information space is organized but also and especially on the way in which information is employed to cause surprise in receivers.

Many specialized information processing centers are available in metropolis, but there is a serious lack of coordination. There is no one clearinghouse to which to turn. The discrepancy which exists between need and the mustering of information and of making it kinetic in the affairs of citizens is approaching a crisis. When left unattended, it is interesting that participants begin to speculate on the contributory affect of a lack of available information upon the urban disorder in the simulated encounter environment.

Information networking and library planning is an extension of the surprise value of information retrieval. Networks and interlibrary cooperation require the combination of materials, services and professional expertise which is impossible to achieve by one library alone. Information networking adds the dimension of an effective switching center at the regional, state and national levels.

Libraries in the simulated metropolis work together through regional library centers in order to avoid unnecessary duplication of resource collections and to facilitate access both to their own resources and to other libraries in the national network. Numerous other information centers exist which function to provide significant services to specialized interests. All of these benefit in varying degrees from the information transfer (bibliographic) network. Each of these may have other needs for information which primarily cannot be met from documents that stem from the usual publishing and other distribution channels.

A good amount of knowledge, particularly that related to the work-a-day life of the people, exists in records and sources that are ephemeral and not

highly organized, or perhaps remain unorganized. This type of knowledge is often mission-oriented. Information is retrieved from such sources only so long as there is an obvious and continuing need, usually for a limited clientele such as a housing project or a neighborhood activist cell. There is another extensive category of knowledge which does not exist in records at all, but is available only in the minds of specialists and professional experts. This kind of knowledge becomes available only upon consultation. The information is rendered kinetic when the individual interfaces with a consulting expert over an immediate problem or specific interests such as Information Volunteers Services of the Health and Welfare Association of Allegheny County.

Finally there is the knowledge of the present moment, the near past and the impending future where the emerging needs of the people help to shape the information sources of the present moment. There are several media of communication in metropolis whose knowledge of the present, the near past and the immediate future is a constant and continuous source of information which few citizens in the area could avoid even if they wanted to do so. Most people's requirements are conditioned partially by the media and partly by their daily occupations. Consequently the information spaces sought, range widely over ephemeral and mission-oriented sources of knowledge. Only a small percentage of the information required every day is sought in the depth for which the bibliographic record is designed to serve. Of course without such inquiry from the record, however small in quantity, civilization would flounder for lack of perspective. In the long run, libraries of the record are an integral element of modern vigorous civilizations, but in the day-to-day preoccupations of people they often seem irrelevant.

Consequently a community-encounter simulated social system has been developed by the Graduate School of Library and Information Science, of the University of Pittsburgh. The encounter simulation has been built upon a cybernetic model of communication for research and instructional purposes. The power-deployment of government and the surprise value of organized information space are the central entropy-reducing components of the model being tested. Social science research methods and distribution-free statistical techniques have been used to study relations of variables in the in-put and out-put phases within and among each other as well as with characteristics of the entropy-reducing components.

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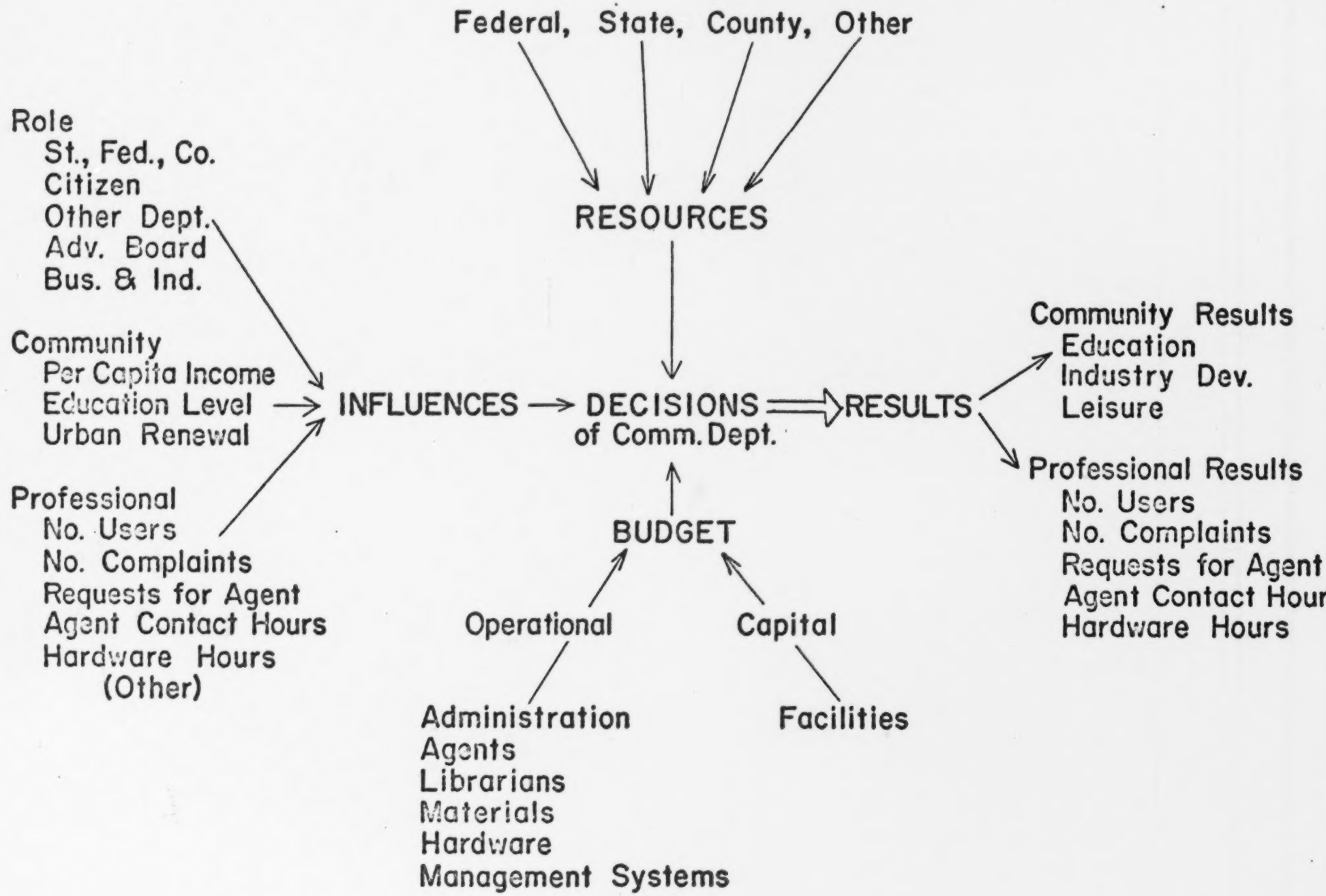
Federal, State, County, Other
RESOURCES
Role
St., Fed., Co.
Citizen
Other Dept.
Adv. Board
Bus. & Ind.
Community
Per Capita Income
Education Level
Urban Renewal
Professional
No. Users
No. Complaints
Requests for Agent
Agent Contact Hours
Hardware Hours
(Other)
INFLUENCES
DECISIONS of Comm. Dept.
RESULTS
BUDGET
Operational
Capital
Administration
Agents
Librarians
Materials
Hardware
Management Systems
Facilities
Community Results
Education
Industry Dev.
Leisure
Professional Results
No. Users
No. Complaints
Requests for Agent
Agent Contact Hours
Hardware Hours

Figure 1

Figure 2

CONVENTIONAL U.A. ROLES FOR COUNTY

Strength of Interaction

▩ Strong

▨ Medium

X Low but some

| Direction of Interaction ← / COMMUNICATION ROLES | Library Council | Comm. Budget Officer | Comm. Manager | Comm. Agent | Comm. Administrator | State Librarian | Fed. Div. of Lib. Progs. | Conventional Librarian | Business and Industry | Tax Association |
|---|---|---|---|---|---|---|---|---|---|---|
| State Administrator | ▩ | | | | | ▨ | | | | X |
| Federal Administrator | ▩ | | | | | | ▨ | | | X |
| County Council | | X | | | X | | | X | | ▩ |
| County Manager | | ▨ | | | ▩ | | | X | | ▨ |
| County Planner | | | ▨ | X | | | | | ▩ | |
| Urban Renewal Director | | | X | X | | | | | ▨ | |
| Anti Poverty Director | | | X | X | | | | | | |
| HEW Administrator | | | X | X | X | | | | | |
| Land Developers | | | X | | | | | | | |
| Citizens | | | | ▨ | | | | | | |

## POTENTIAL CONFLICT

Conflict = Two or more groups competing for limited resources, power positions, prestige etc, resisting change or the threat of change.

▨ High
▨ Med
X Low

Direction of Interaction ←

| | | 1 State | 2 Federal | 3 State Lib. | 4 Fed. Div. of Lib. | 5 Manager | 6 Planner | 7 Communications | 8 Renewal | 9 Poverty (CAP) | 10 HEW | 11 Land Dev. | 12 Citizens | 13 Comm. Budget | 14 " Planner | 15 " Agents | 16 Conv. Lib. | 17 County Council | 18 Council of Lib. | 19 Tax Assn. | 20 Business & Ind. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | State Administrator | | X | X | | ▨ | X | | X | X | X | | | | X | | | X | ▨ | | |
| 2 | Federal Administrator | X | | | ▨ | ▨ | ▨ | | ▨ | ▨ | ▨ | | | | | | | X | ▨ | ▨ | |
| 3 | State Librarian | X | | | | | | X | | | | | | | ▨ | | X | | ▨ | | |
| 4 | Fed. Div. of Libraries | | X | X | | | | X | | | | | | | | | | | ▨ | | |
| 5 | County Manager | ▨ | ▨ | | | | X | X | X | X | X | ▨ | ▨ | ▨ | | | | ▨ | | | |
| 6 | County Planner | X | ▨ | | | X | | | ▨ | ▨ | X | ▨ | X | | X | | | ▨ | | | ▨ |
| 7 | County Communications | X | X | ▨ | | X | | | | X | X | | X | | | X | X | ▨ | ▨ | | |
| 8 | Urban Renewal | X | ▨ | | | X | X | | | X | | ▨ | | | | | | | | | |
| 9 | Anti Poverty (CAP) | X | ▨ | | | X | ▨ | X | | | | | | | | | | | | | |
| 10 | HEW | X | ▨ | | | X | X | X | | | | | | | | | | | | | |
| 11 | Land Developer | | | | | ▨ | ▨ | | ▨ | | | | | | | | | | | | |
| 12 | Citizens | | | | | ▨ | | | ▨ | | | | | | | | | | | | |
| 13 | Communications Budget | | | | | ▨ | | | | X | X | | | | | | ▨ | | | | |
| 14 | " Planner | X | | ▨ | | | X | | | | | | | | | | X | | | | |
| 15 | " Agents | | | | | | | | | | | | X | | | | ▨ | | | | |
| 16 | Conventional Librarians | | | X | | | | X | | | | | | ▨ | X | ▨ | | | X | | |
| 17 | County Council | X | X | | | ▨ | ▨ | ▨ | | | | | | | | | | | | ▨ | |
| 18 | Council of Librarians | ▨ | ▨ | ▨ | ▨ | | | X | | | | | | | | | X | | | | |
| 19 | Tax Association | | ▨ | | | | | | | | | | | | | | | ▨ | | | |
| 20 | Business and Industry | | | | | | ▨ | | | | | | | | | | | | | | |

Figure 3